

Patent Application
2771-396 CIP II (7493)

Section III. REMARKS

Request for Rejoinder Reminder

The Examiner is respectfully reminded that applicants previously requested rejoinder of method claims 30-55 upon allowance of the product claims. Towards that end, withdrawn method claims 32 and 44 have been amended in a manner consistent with the pending composition claims.

Claim Objection

Claim 14 was objected to because the acronym "TEAHF" is not specified. In response, applicants have amended claim 14 and the corresponding citation in the specification to replace the acronym "TEAHF" with "TEAF."

Allowable Subject Matter

Claims 13-16, 28 and 29 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In response, claims 28 and 29 have been written in independent form as new claims 57 and 58, respectively. Consistent with the Examiner's indication of prospective allowability of claims 28 and 29, new claims 57 and 58 are in form and condition for allowance.

Applicants also acknowledge the Examiner's contingent allowance of claims 13-16 and respectfully request reconsideration of all pending claims 1-21, 25-29 and 56-58 in light of the subsequent discussion.

Amendment of Claims 1, 27 and 56 and Cancellation of Claims 22-24, 35-37 and 48-50

Claim 1 has been amended to recite:

"[a] post CMP cleaning formulation comprising an organic amine, a fluoride source and from 70% to 98% water by weight, based on the total weight of the formulation, wherein the pH of the post CMP cleaning formulation is between about 7 and about 9."

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Support for this amendment can be found in the disclosure at page 12, lines 13-15 and page 14-15, Table 2. Claim 56 has been amended correspondingly to claim 1.

Claim 27 has been amended herein to depend from claim 26 instead of claim 25.

Claims 22-24, 35-37 and 48-50 have been cancelled herein because they are exactly or substantially verbatim with claims 18-20, 31-33 and 44-46, respectively.

Rejection of Claims and Traversal Thereof

In the April 23, 2004 Office Action:

claims 1, 4-8, 10, 12, 17-19, 22 and 23 were rejected under 35 U.S.C. §102(b) as being anticipated by Keeney (U.S. Patent No. 4,371,443);

claims 2 and 9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Keeney in view of Borah (U.S. Patent No. 5,421,906);

claims 3, 11, 20, 21, 24 and 25 were rejected under 35 U.S.C. §103(a) as being unpatentable over Keeney as applied to claim 1 above, and further in view of Schonauer et al. (U.S. Patent No. 5,662,769);

claims 26 and 27 were rejected under 35 U.S.C. §103(a) as being unpatentable over Keeney in view of Schonauer et al. as applied to claim 17 above, and further in view of Wojtczak et al. (WO 98/00244); and

claim 56 was rejected under 35 U.S.C. §103(a) as being unpatentable over Keeney in view of Schonauer et al.

These rejections are traversed in application to pending claims 1-29 and 56-58. The various grounds of rejection are addressed in turn below.

Rejection under 35 U.S.C. §102(b)

In the April 23, 2004 Office Action, claims 1, 4-8, 10, 12, 17-19, 22 and 23 were rejected under 35 U.S.C. §102(b) as being anticipated by Keeney (U.S. Patent No. 4,371,443). Applicants traverse such rejection.

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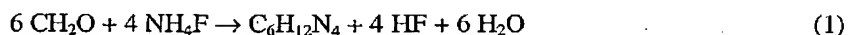
According to the Examiner, Keeney teaches an aqueous composition containing ammonium fluoride, formaldehyde and hexamethylenetetramine (HMTA), and as such, the Keeney reference anticipates applicants' claimed invention.

It is well established as a matter of law, that a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987).

Applicants' claim 1, as amended, recites:

"[a] post CMP cleaning formulation comprising an organic amine, a fluoride source and from 70% to 98% water by weight, based on the total weight of the formulation, wherein the pH of the post CMP cleaning formulation is between about 7 and about 9." (emphasis added)

The Keeney formulation cited by the Examiner reacts according to the following reaction, whereby the acids HMTA ($C_6H_{12}N_4$, $pK_a = 5.13^1$) and HF ($pK_a = 3.2$) are formed as shown in the following equation:



It is very obvious that the solutions formed by the above chemical equation are acidic. In addition, as stated by the Examiner the acidic solution also includes additional HMTA, which will certainly provide additional acidic components to the composition. Qualitatively, the Keeney solution must be acidic to dissolve calcareous rock, e.g., limestone, in subterranean formations. Further support that the Keeney formulation is acidic can be found in the Keeney disclosure itself whereby the Keeney formulation is referred to as the "acid(ic) composition" no less than twenty (20) times (see Keeney: col. 3, line 33; col. 3, line 37-38; col. 3, line 40; col. 3, line 46; col. 3, line 65; col. 4, lines 7-8; col. 4, line 14; col. 4, lines 16-17; col. 4, line 30; col. 4, lines 32-33; col. 4, line 40; col. 4, line 58; col. 4, line 64; col. 4, line 65; col. 5, line 2; col. 5, line 6; col. 5, line 20; col. 6, line 32; and col. 7, line 17).

As such, the composition as taught by Keeney is an acidic composition, and considering the pK_a values of such acids, clearly the pH is much less than 7.

¹ These pK_a values are indicative of acidic solutions.

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In contrast, applicants' claim 1 recites a composition having a pH between about 7 and about 9.

The Examiner is respectfully reminded that should she contend that the pH of the Keeney composition is inherently in the pH range claimed in applicants' claim 1, she must provide extrinsic evidence making it clear "that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." See, *In re Robertson*, 49 U.S.P.Q.2d 1949, 1950-51 (Fed. Cir. 1999). Moreover, the fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherency. *Id.* Instead, the certain thing must occur each and every time and speculation regarding the possibility of a result is not sufficient to meet the inherency standard. Clearly, this is a burden the Examiner can never expect to meet in view of the fact that Keeney describes their formulation as an "acid(ic) composition" no less than twenty times and the composition comprises acidic components with pK_a values indicative of acidic solutions.

It is therefore apparent from the foregoing that Keeney does not anticipate applicants' claim 1, and claims 4-8, 10 and 12 dependent thereunder.

Applicants' claim 17 recites:

"[a] semiconductor wafer cleaning formulation comprising the following components in the percentage by weight ranges shown, based on the total weight of such components:

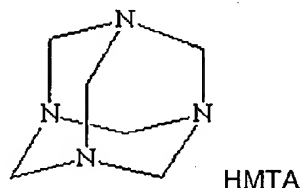
fluoride source	1-35%
organic amine(s)	20-60%
a nitrogenous component, selected from nitrogen-containing carboxylic acids and imines	0.1-40%
water	20-50% and
metal chelating agent(s)	0-21%
TOTAL	100%."

Clearly claim 17 comprises "a nitrogenous component, selected from nitrogen-containing carboxylic acids and imines" however after a very thorough review of the Keeney reference, applicants could not find any description, suggestion or teaching, either expressly or inherently, for the inclusion of "a nitrogenous component, selected from nitrogen-containing carboxylic acids and imines."

The Keeney reference discloses an ammonium halide compound which contains a nitrogen atom but is certainly not a nitrogen-containing carboxylic acid ($-COOH$) or imine ($=NH$). The other compound

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mentioned in the Keeney reference that includes a nitrogen atom is HMTA and a quick review of the structure will illustrate that it is also not a nitrogen-containing carboxylic acid.



Likewise, the structure of HMTA is clearly not an imine. Thus, claim 17 and all claims depending therefrom are not anticipated by Keeney. Notably, this was admitted by the Examiner in the April 23, 2004 Office Action (see page 5, lines 4-5) ("Keeney differs in failing to teach the cleaning formulation comprises a nitrogenous component"). Thus, Keeney does not anticipate applicants' claim 17, and claims 18, 19, 22 and 23 dependent thereunder.

Applicants therefore respectfully request that the §102(b) rejection of claims 1, 4-8, 10, 12, 17-19, 22 and 23 over Keeney be withdrawn.

Rejection under 35 U.S.C. §103(a)

1. In the April 23, 2004 Office Action, claims 2 and 9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Keeney in view of Borah (U.S. Patent No. 5,421,906). Applicants traverse such rejection.

Borah discloses a composition to extract contaminants, such as PCBs, radionuclides, herbicides, and heavy metals, from smooth and/or porous surfaces "without significant surface damage or scarring." Said smooth and/or porous surfaces may include particulate surfaces, e.g., sand, clay, and gravel. The Borah cleaning composition includes sulfamic acid, hydrofluoric ammonium bifluoride, HCl, cationic surfactant, sodium citrate, triethanolamine, oxalic acid, and optionally d-limonine.

Keeney teaches an acidic composition that is formulated to dissolve calcareous rock in subterranean formations, thereby increasing the permeability and permitting better flow of fluids, e.g., oil, through the formation. As stated above, the Keeney composition is clearly considered to be an acidic composition.

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According to the Examiner:

"Keeney differs in failing to teach said formulation further comprises a metal chelating agent . . . Borah teaches an aqueous composition that comprises oxalic acid (same as applicants' chelate . . . It would have been obvious to one having ordinary skill in the art . . . to modify Keeney's composition by employing oxalic acid, as taught by Keeney[sic] for the purpose of removing stains of iron oxide"

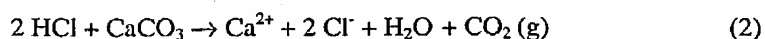
Applicants vigorously disagree.

As introduced hereinabove, Keeney does not motivate, teach or suggest every limitation of applicants' claimed invention, specifically a post CMP cleaning formulation having a pH between about 7 and about 9. Borah does not cure this deficiency.

The pre-cleaning fluid of Borah that the Examiner cited in the April 23, 2004 Office Action should have a pH of 0 if the contaminant is a radionuclide or heavy metal, a pH of 2.5 if the contaminant is PCB, and a pH of 0 if the contaminant is herbicides/pesticides (see Borah, col. 10, lines 59-68). Clearly, the combination of the "acidic composition" of Keeney and the highly acidic pre-cleaning fluids of Borah yields a net solution that is acidic. Thus, the combination of the two references, does not motivate, teach or suggest every limitation of applicants' claimed invention.

Further, there is no motivation, teaching or suggestion in either Keeney or Borah to increase the pH of the respective compositions from acidic values, as discussed hereinabove, to "about pH 7 to about pH 9," i.e., applicants' claim 1.

The Keeney composition is formulated to dissolve calcareous, i.e., limestone, rock in subterranean formations. It is well known in the art that limestone is composed principally of calcium carbonate (CaCO_3), which is a basic solid and as such, limestone only dissolves in the presence of acidic solutions. When determining if limestone is present in a rock sample, the standard test is to add a drop of hydrochloric acid to the surface of the rock. If fizzing is observed at the locus of the drop addition, it is known that calcium carbonate is present in the rock. The reaction occurs according to the following equation (2), wherein the calcium carbonate dissolves in the presence of HCl to form carbon dioxide (and hence the fizzing occurs).



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Understanding the chemistry of the dissolution of calcereous rock, whereby the calcereous components are basic and only dissolve in acidic solutions, applicants question - where is the motivation or suggestion to raise the pH from those acidic values taught in Keeney to the values recited in applicants' claim 1, i.e., about pH 7 to about pH 9? Clearly there is none and the Examiner cannot conjure up such a motivation or suggestion that is chemically feasible in view of the purpose of the Keeney composition.

The Borah composition is formulated to extract contaminants, such as PCBs, radionuclides, herbicides, and heavy metals, from smooth and/or porous surfaces such as metals, concretes, rocks, and particulate matter. Ostensibly, the Borah composition is used to remediate contaminated surfaces.

The chemistry of remediation is well understood. For example, to extract PCBs, pesticides and heavy metals from contaminated soil, sediment, concrete, bedrock or sludge, acids are used (see, <http://www.envirotools.org/remediation/remedisoiused-try.shtml>). To extract radionuclides from concrete substances requires the employment of dilute HCl (see, http://emsp.em.doe.gov/EMSPprojects1996_2003/Deactivation/648961999.pdf).

Likewise, understanding the chemistry of the extraction of contaminants such as PCB, heavy metals, pesticides and radionuclides, whereby acidic solutions are used, applicants again question where is the motivation or suggestion to raise the pH from those highly acidic values (low pH) taught in Borah to the values recited in applicants' claim 1, i.e., about pH 7 to about pH 9? Clearly there is none.

As such, upon combining the Keeney and Borah references, the combination of the solution is still acidic and clearly there is no motivation, teaching or suggestion to raise the pH to about pH 7 to about pH 9, as recited in applicants' claim 1 because the modification suggested by the Examiner would render both compositions inoperable for their intended purposes.

Accordingly, the combination of Keeney and Borah does not teach or suggest every limitation of applicants' claims, and there is no motivation to modify the Keeney or Borah solutions, or the combination thereof. Applicants respectfully request withdrawal of the rejection of claims 2 and 9 under 35 U.S.C. §103(a) based on Keeney in view of Borah.

2. In the April 23, 2004 Office Action, claims 3, 11, 20, 21, 24 and 25 were rejected under 35 U.S.C. §103(a) as being unpatentable over Keeney as applied to claim 1 above, and further in view of Schonauer et al. (U.S. Patent No. 5,662,769) (hereinafter Schonauer). Applicants traverse such rejection.

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Schonauer teaches a solution for cleaning iron contaminants bound to a metallized semiconductor surface after CMP planarization.

According to the Examiner:

"Keeney differs in failing to teach the cleaning formulation comprises a nitrogenous component . . . Schonauer teaches, " . . . contaminants introduced . . . by the CMP processing . . . can be removed from the wafer by a cleaning solution containing . . . EDTA . . . It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Keeney by employing Schonauer's EDTA for the purpose of releasing all buried contaminants from beneath the surface"

Applicants vigorously disagree.

As introduced hereinabove, Keeney does not motivate, teach or suggest every limitation of applicants' claim 1, upon which claims 3 and 11 depend, specifically a post CMP cleaning formulation having a pH between about 7 and about 9. Schonauer does not cure this deficiency. The EDTA solution of Schonauer was maintained at a pH of 2 (see Schonauer, col. 3, lines 1-2). Further, the EDTA/HF solution was prepared using the EDTA solution having a pH of 2 (see Schonauer, col. 3, lines 39-41). Clearly, the combination of the "acidic composition" of Keeney and the acidic EDTA of Schonauer yields a net solution that is still acidic. Thus, the combination of the two references, does not motivate, teach or suggest every limitation of applicants' claimed invention.

It is therefore apparent that the combination of Keeney and Schonauer does not render applicants' claims 3 and 11, which are dependent on claim 1, obvious.

Regarding the rejection of claim 17, as introduced hereinabove, Keeney does not motivate, teach or suggest every limitation of applicants' claim 17, upon which claims 20, 21, 24 and 25 depend. Specifically, the elements of claims 17 that are not taught by Keeney include a 0.1-40% nitrogenous component and 20-50% water.

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Schonauer teaches the use of a 0.1 M EDTA solution (see Schonauer, col. 2, line 67 through col. 3, lines 1-2).² Assuming 1 L of solution and knowing the molar mass of EDTA, 0.1 M EDTA corresponds to approximately 3 wt %. Upon combination of the Schonauer EDTA with the Keeney composition, which is disclosed as a 25 mL sample containing 2.35 g of ammonium fluoride (~ 9 wt %³), 2.86 g of formaldehyde (~ 11 wt %) and 1.83 g of HMTA (~ 7 wt %), the net composition will consist of approximately 70 % by weight of water.

It is apparent that upon combination of the Keeney and Schonauer references, as proposed by the Examiner, the net composition does not comprise 20-50 wt % water, as required by applicants' claim 17. As such, the combination of Keeney and Schonauer does not render applicants' claims 20, 21, 24 and 25, which are dependent on claim 17, obvious.

Accordingly, the combination of Keeney and Schonauer does not motivate, teach or suggest every limitation of applicants' claims. Applicants respectfully request withdrawal of the rejection of claims 3, 11, 20, 21, 24 and 25 under 35 U.S.C. §103(a) based on Keeney in view of Schonauer.

3. In the April 23, 2004 Office Action, claims 26 and 27 were rejected under 35 U.S.C. §103(a) as being unpatentable over Keeney in view of Schonauer as applied to claim 17 above, and further in view of Wojtczak et al. (WO 98/00244) (hereinafter Wojtczak '244). Applicants traverse such rejection.

Wojtczak '244 teaches a composition that effectively removes inorganic residues following a plasma ashing step, wherein the composition comprises 2-98 % chelating agent and 2-98 % solvent and is devoid of any amine-containing compounds (see Wojtczak '244, page 2, lines 10-12; see also page 3, lines 1-3 and page 5, lines 26-27).

According to the Examiner:

"[i]t would have been obvious to one having ordinary skill in the art . . . to modify Keeney in view of Schonauer by using compounds having the said structure, -CHR-Y, as taught by Wojtczak's [sic] for the purpose of removing inorganic residues"

² note, Schonauer also teaches the use of a 0.0017M EDTA/0.056M HF solution, however, the calculated weight percentages are even smaller.

³ based on an approximate density of the Keeney solution of 1 g/mL to 1.1 g/mL.

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Applicants vigorously disagree.

As introduced hereinabove, Keeney in view of Schonauer does not render applicants' claim 17, upon which claims 26 and 27 depend, obvious for several reasons, including the combination of Keeney and Schonauer does not motivate, teach or suggest every limitation of applicants' claimed invention. Wojtczak '244 does not cure this deficiency.

It is well established as a matter of law that it is improper to combine references where the references teach away from their combination. *See, e.g., In re Grasselli*, 218 U.S.P.Q. 769, 779 (Fed. Cir. 1983). Wojtczak expressly discloses that the composition must not contain any amine compounds (see Wojtczak '244, page 2, lines 10-12; see also page 3, lines 1-3 and page 5, lines 26-27). 'Thus, one skilled in the art would not be motivated to combine Wojtczak '244 with the Keeney reference, or any combination containing the Keeney reference, because Keeney teaches the inclusion of an amine in the formulation.'⁴

Accordingly, Wojtczak '244 teaches away from any combination with Keeney. Applicants respectfully request withdrawal of the rejection of claims 26 and 27 under 35 U.S.C. §103(a) based on Keeney, Schonauer and Wojtczak '244.

4. In the April 23, 2004 Office Action, claim 56 was rejected under 35 U.S.C. §103(a) as being unpatentable over Keeney in view of Schonauer. Applicants traverse such rejection.

Claim 56, as amended, recites:

"[a] wafer cleaning formulation, including (i) a fluoride source, (ii) at least one organic amine, (iii) a nitrogen-containing carboxylic acid or an imine, (iv) water, and optionally at least one metal chelating agent, wherein the pH of the wafer cleaning formulation is between about 7 and about 9." (emphasis added)

For the reasons enumerated hereinabove, the combination of Keeney and Schonauer does not motivate, teach or suggest every limitation of applicants' claim 56, specifically a wafer cleaning formulation having a pH between about 7 and about 9.

⁴ further, HMTA is a product of the ammonium fluoride plus formaldehyde reaction of Equation (1).

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Accordingly, applicants respectfully request withdrawal of the rejection of claim 56 under 35 U.S.C. §103(a) based on Keeney in view of Schonauer.

Fees Payable for Added Claims 57 and 58

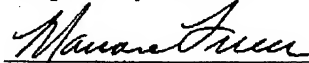
Two (2) independent claims have been added and nine (9) dependent claims have been cancelled herein. As such, an added claims fee of $[(2 \times \$86) + (2 \times \$18)] - (9 \times \$18) = \46.00 is due.

The total fee of \$46.00 is authorized to be charged in the attached credit card authorization form. Authorization is also hereby given to charge any deficiency in applicable fees for this response to Deposit Account Number 08-3284 of Intellectual Property/Technology Law.

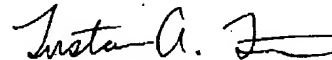
Section III. CONCLUSION

Applicants have satisfied all the requirements for patentability. All pending claims are free of the art and fully comply with the requirements of 35 U.S.C. §112. It therefore is requested that Examiner Umez Eronini reconsider the patentability of claims 1-29 and 56 in light of the distinguishing remarks herein and withdraw all rejections, thereby placing the application in condition for allowance. Notice of the same is earnestly solicited. Applicants request that withdrawn claim 30-55 be rejoined and examined at this time. In the event that any issues remain, Examiner Umez Eronini is requested to contact the undersigned attorney at (919) 419-9350 to resolve same.

Respectfully submitted,



Marianne Fuierer
Reg. No. 39,983
Attorney for Applicants



Tristan Anne Fuierer
Reg. No. 52,926
Attorney for Applicants

INTELLECTUAL PROPERTY/
TECHNOLOGY LAW
P.O. Box 14329
Research Triangle Park, NC 27709
Telephone: (919) 419-9350
Fax: (919) 419-9354
Attorney Ref: 2771-396 CIP II (7493)